Niagara Mohawk®

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October 17, 2000
NMP2L 1991

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

RE: Docket No. 50-410
Licensee Event Report 00-14

Gentlemen:

In accordance with 10 CFR 50.73(a)(2)(iv), we are submitting Licensee Event Report 00-14, "Reactor Trip on Turbine Trip Due to High Vibrations."

Very truly yours,

John T. Conway
Vice President Nuclear Generation

JTC/CES/kap
Attachment

xc: Mr. H. J. Miller, NRC Regional Administrator, Region I
Mr. G. K. Hunegs, NRC Senior Resident Inspector
Records Management

IE22

NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES:

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Nine Mile Point Unit 2	05000410	01 OF 05

TITLE (4)
Reactor Trip on Turbine Trip Due to High Vibrations

EVENT DATE (5)			LER NUMBER (6)					REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR		SEQUENTIAL NUMBER		REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
09	17	00	00		14		00	10	17	00	N/A	
											N/A	

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check one or more of the following)* (11)			
POWER LEVEL (10) 70%	1	☐ 20.2201(b)	☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)	☐ 50.73(a)(2)(viii)
		☐ 20.2203(a)(1)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(ii)	☐ 50.73(a)(2)(x)
		☐ 20.2203(a)(2)(i)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(iii)	☐ 73.71
		☐ 20.2203(a)(2)(ii)	☐ 20.2203(a)(4)	☒ 50.73(a)(2)(iv)	☐ OTHER *(Specify in Abstract below and in Text, NRC Form 366A)*
		☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(1)	☐ 50.73(a)(2)(v)	
		☐ 20.2203(a)(2)(iv)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
Larry C. Newman, Manager Operations Unit 2	(315) 349-7372

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
☐ YES *(If yes, complete EXPECTED SUBMISSION DATE)*	☒ NO				

ABSTRACT *(Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines)* (16)

On September 17, 2000, at 1520 hours, while starting up from a planned outage for Noble Metal Chemical Addition, Nine Mile Point Unit 2 experienced a turbine trip and subsequent reactor trip from approximately 70% power as a result of high vibration sensed by turbine bearing number 8 instrumentation.

The cause of the high vibration was oil whip/whirl. Oil whip/whirl is the movement of the oil wedge that is present between the turbine shaft and bearing sleeve. This oil movement caused high vibration.

The corrective action was to revise procedures to direct operating the turbine oil system at a higher temperature. Additional turbine instrumentation was installed to monitor turbine vibration while placing the plant back into service.

I. DESCRIPTION OF EVENT

On September 17, 2000 at 1520 hours, while starting up from a planned Noble Metal Chemical Addition Outage, Nine Mile Point Unit 2 (NMP2) experienced a turbine trip and subsequent reactor trip from approximately 70% power. The turbine trip was caused by an increase in turbine bearing number 8 vibration above the trip setpoint of 14 mils for approximately 23 seconds (high vibration must be sensed for a minimum of 3.5 seconds to initiate a turbine trip). As designed, the turbine trip generated a turbine control valve fast closure reactor trip signal.

Reactor level was initially recovered with Feedwater Pumps "A" and "C" and level was maintained between 143 inches and 205 inches. Reactor Feedwater Pump "C" was secured when water level reached 190 inches. Due to leakage past the Feedwater Level Control Valves 2FWS-LV10A and/or 2FWS-LV10C, reactor water level reached Level 8 (202.3 inches) and Feedwater Pump "A" tripped as designed. The operators reduced reactor pressure by using a turbine bypass valve to allow the use of the condensate booster pumps for level control. As reactor pressure was lowered, a second reactor trip occurred when reactor water level reached Level 3 (159.3 inches). Reactor water level reached a minimum of 143 inches.

All control rods fully inserted on the trip signal. The maximum reactor pressure during the transient was 1019 psig. No safety relief valves lifted nor were they expected to lift as a result of this transient. The electrical systems operated as designed. Reactor vessel cool down rate remained less than 100 degrees Fahrenheit (F) per hour limit during the trip recovery phase as required by Technical Specifications.

Primary Containment Isolation Group 4 (residual heat removal radwaste discharge and sampling valves) and Group 5 (residual heat removal shutdown cooling valves and other system valves) received isolation signals due to reactor water level below the isolation setpoint of 159.3 inches (Level 3). The Primary Containment Isolation Group 4 valves were closed except for the Radwaste Discharge Valves, 2RHS*MOV142 and 2RHS*MOV149 which were open prior to the trip because of suppression pool pump down that was in progress. These valves closed as expected on the Group 4 isolation signal. Group 5 isolation valves were in their normal, closed positions; therefore, these valves did not change position.

II. CAUSE OF EVENT

The cause of the high vibration was oil whip/whirl. Oil whip/whirl is the movement of the oil wedge that is present between the turbine shaft and bearing sleeve. This oil movement caused high vibration. Oil whip/whirl can be caused by a changing relationship between the shaft and bearing caused by any of a number of factors such as bearing loading, clearances, alignment, eccentricity, oil temperature and pressure, or changing loads on the turbine. The Turbine Lube Oil System was being operated low in the temperature band (110 - 120 degrees F) at approximately 111 degrees F, which made conditions favorable for oil whip/whirl to occur.

III. ANALYSIS OF EVENT

This event is reportable in accordance with 10 CFR 50.73(a)(2)(iv), any operation or condition that resulted in a manual or automatic actuation of any engineered safety feature, including the Reactor Protection System. Turbine trips are an incident of moderate frequency as defined in the Updated Safety Analysis Report (USAR). The plant response to the transient is bounded by the USAR analysis. In general, the turbine trip event was less severe than the USAR description because of the reduced power at the time of the trip and operator action that was taken to mitigate the consequences of the trip. None of the equipment issues discussed in this report impact the design analysis. The USAR description assumes a level 8 trip of the operating feedwater pump(s).

All control rods fully inserted in response to the reactor trip signal. Reactor water level was initially recovered with the Feedwater System. Leakage past the feedwater level control valves led to securing Feedwater Pump "C" and the automatic tripping of Feedwater Pump "A." Level control was established by reducing reactor pressure and using the condensate booster pumps. As reactor pressure was lowered, a reactor trip occurred at Level 3. No control rod movement occurred since all control rods had been previously inserted. Except for Low Pressure Coolant Injection (LPCI) "B", all Emergency Core Cooling Systems were operable and in standby throughout this event. LPCI "B" had been declared inoperable prior to the trip to support the flush of "B" Shutdown Cooling. LPCI "B" was restored to an operable status fifteen minutes after the reactor trip.

Niagara Mohawk Power Corporation performed a probabilistic risk analysis of this event and calculated a conditional core damage probability of 8.2E-7/year.

Based on the information provided above, there were no adverse safety consequences as a result of this event. The reactor trip and recovery posed no threat to the health and safety of the general public or plant personnel.

IV. CORRECTIVE ACTIONS

1. NMP2 revised operating procedures to raise the operating temperature of the Turbine Lube Oil System.

2. Procedure N2-SOP-101C was revised to include guidance on how to compensate for the leaking feedwater level control valves.

3. The turbine vendor and two turbine consultants independently reviewed the results of the root cause. Each concurs with the findings and corrective actions.

4. The Operations Department has briefed all operating crews on the circumstances surrounding this event and the corrective actions taken to eliminate the possibility of a similar trip.

5. The Turbo-Balancer was installed and in operation during Turbine startup to assure that appropriate vibration data could be gathered during power ascension.

V. ADDITIONAL INFORMATION

A. Failed components: none

B. Previous similar events:

Licensee Event Reports 95-08, "Reactor Manual Scram on High Turbine-Generator Vibration" and 95-05, Supplement 1, "Reactor Manual Scram to Protect Turbine-Generator from High Vibration" document plant trips as a result of high vibrations on the main turbine. The vibrations resulted from "packing rub" associated with design of the low pressure turbine which had been recently replaced. The causes of these two previous events are different.

C. Identification of components referred to in this licensee event report:

Components	IEEE 803A Function	IEEE 805 System ID
Reactor Vessel	RPV	AD
Main Turbine Control Valve	PCV	TA
Safety Relief Valves	RV	SB
Emergency Core Cooling Systems	N/A	BG, BM, BO, BN
Feedwater Control Valves	LCV	SJ
Feedwater Pumps	P	SJ
Condensate Booster Pumps	P	SD
Turbine Bypass Valves	V	JI
Turbine Lube Oil System	N/A	TD
Residual Heat Removal Shutdown Cooling Valves	V	BO
Residual Heat Removal Sample Valves	V	BO
Residual Heat Removal Radwaste Discharge Valves	V	BO
Control Rods	ROD	AA

V. ADDITIONAL INFORMATION (Cont'd.)

C. Identification of components referred to in this licensee event report:

Components	IEEE 803A Function	IEEE 805 System ID
Primary Containment Isolation Valves	V	JM
Suppression Pool	N/A	N/A
Vibration Instrumentation	VI	JJ
Turbine	TRB	TA
Shaft	N/A	TA
Bearing	N/A	TA